SUMMARY OF CLAIMED SUBJECT MATTER

The invention presents a method and device that effectively combusts heavy hydrocarbon fuel oils by injecting them through a zone of combusting hydrogen where the oil is finely dispersed, partially vaporized and ignited. The zone of combusting hydrogen is formed by generating hydrogen and oxygen gas from an external electrolytic cell and piped to a plurality of nozzles on the burner's front face. The outlet ports of these nozzles point toward the axial center of the burner face. The hydrogen and oxygen gas flowing out of these ports is then ignited to produce relatively short flame jets having the tips meet along the axis of the burner. The burner head is then rotated at relatively high speed. Under rotation, the individual hydrogen gas flames form wrap together into a conical-shaped flame zone. The fuel oil can be mixed with water or steam and sprayed directly into the combusting hydrogen flame zone. The intense heat and turbulence inside the hydrogen flame zone serves to further disperse and vaporize the heavy fuel oil to promote the oil's combustion. The presence of water or steam also catalyzes a reforming reaction on contact with the hydrogen flame fronts. The hydrogen flame cone also continuously ignites the combusting oil, which forms a second fuel flame downstream of the hydrogen flame zone. The hydrogen flame zone remains stable while the

fuel/water/steam mixture is sprayed through it due the unique properties of hydrogen gas (i.e., fast flame speed).

INDEPENDENT CLAIM MAPPING

1.(currently amended) A method of combusting a liquid primary fuel comprising the steps of:

establishing a first zone of combustion (p. 20, lines 4-5) formed by radially inwardly directed intersecting flames (p. 20, lines 4-6; FIG. 1) comprised essentially of burning hydrogen gas (p. 20, line 4) supplied from an external source (p. 24, lines 1-2) and spaced from a fuel nozzle (FIG. 1),

establishing a second zone of combustion comprising an atomized primary fuel that is ignited by contact with the first zone of combustion (p. 21, lines 1-6).

DEPENDENT CLAIM MAPPING

2.(currently amended) The method of claim 1 wherein the first zone of combustion is established by the steps of:

providing a pressurized source of hydrogen through a conduit having a discharge opening adjacent to said first zone of combustion (p. 20, lines 4-5, FIG. 1),

igniting the hydrogen exiting through said discharge opening to produce a hydrogen flame (p. 20, lines 4-5); and

mechanically rotating the hydrogen flame about a longitudinal axis of the first zone of combustion (p. 20, lines 5-9).

4.(currently amended) The method of claim 2 where the hydrogen flowing through the conduit includes at least a stoichiometric amount of oxygen to sustain combustion of the hydrogen (p. 24, lines 3-5).

6.(previously presented) The method of claim 2 wherein a speed of the rotating hydrogen flame in a circumferential direction is not less than the forward flame velocity of the ignited hydrogen (p. 23, lines 6-10).

7.(previously presented) The method of claim 1 wherein said step of dispersing said liquid primary fuel further comprises flowing a pressurized source of liquid primary fuel through a conduit of a rotating shaft and including a discharge end having an

atomizing nozzle to discharge the liquid primary fuel into the zone of combustion. (p. 21, lines 1-2; FIG. 1; p. 29, lines 7-8; p. 30, lines 7-8; FIG. 2; p. 38, line 4)

8. (canceled)

9. (previously presented) The method of claim 1 where said primary fuel is selected from the group comprising processed and unprocessed vegetable oils, by-product oils from agricultural products processing, liquid and liquefied petroleum fuels, and liquid and liquefied animal fats. (p. 1, line 1; p. 9, line 11; p. 10)

10.(currently amended) The method of claim 2 where the step of providing pressurized hydrogen from the hydrogen source further includes the steps of:

generating a constant rate of hydrogen and oxygen gases from the electrolysis of water (p. 24, line 3), and

transferring the hydrogen and oxygen gases into a fixed-volume staging chamber such that the hydrogen and oxygen gases are continuously exposed to an inlet opening of the conduit (p. 30, lines 1-2).

11. (currently amended) The method of claim 1 further including a step of injecting a controlled rate of an additive selected from steam or water into the first zone of combustion (p. 33, line 19).

12.(currently amended) The method of claim 11 wherein the injection of said additive is accomplished by pre-mixing the additive at a controlled rate with the liquid primary fuel (p. 33. line 19).

24.(currently amended) The method of claim 2 further comprising the steps of providing a second conduit (p. 23, line 4; FIG. 1) for delivering hydrogen through a second discharge opening adjacent to the first zone of combustion, igniting the hydrogen discharging through said second discharge opening to produce a second hydrogen flame, and rotating said second hydrogen flame about the longitudinal axis (p. 20, line 4-7).

25.(previously presented) The method of claim 24 further comprising the steps of providing a plurality of additional conduits for delivering hydrogen through additional discharge openings with said additional discharge openings extending radially outward from the longitudinal axis relative to the

first two hydrogen discharge openings, igniting the hydrogen discharging through said additional conduits to produce a plurality of hydrogen flames, and rotating said plurality of hydrogen flames about the longitudinal axis in the same rotational direction as said first and second discharge openings (p. 23, line 4).

26.(previously presented) The method of claim 25 where the plurality of additional conduits for delivering hydrogen are rotated in a direction opposite to the first and second conduits along the longitudinal axis (p. 25, lines 10-12).